

## PATENT COOPERATION TREATY

PCT Rec'd PCT/EP 14 SEP 2004

INTERNATIONAL PRELIMINARY EXAMINATION REPORT  
(PCT Article 36 and Rule 70)

REC'D 07 JUL 2004



WIPO PCT

Applicant's or agent's file reference TT3056WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/EP 03/02910	International filing date (day/month/year) 20.03.2003	Priority date (day/month/year) 20.03.2002
International Patent Classification (IPC) or both national classification and IPC C08B15/00		
Applicant TECNOTESSILE SOCIETA NAZIONALE DI RICERCA ...		

- This International preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 4 sheets, including this cover sheet.
  - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

- This report contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the International application
  - VIII ☐ Certain observations on the International application

Date of submission of the demand  20.10.2003	Date of completion of this report  08.07.2004
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Lensen, H  Telephone No. +31 70 340-2428  

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/EP 03/02910**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*):

**Description, Pages**

1-19 as originally filed

**Claims, Numbers**

1-12 received on 14.06.2004 with letter of 14.06.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-12
	No: Claims	
Inventive step (IS)	Yes: Claims	1-12
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

1). Reference is made to the following document:

D1:WPI/Derwent 2002-137956 [18] & TW-A-429280

2). Art. 33(2) PCT (Novelty) :

No document of the available prior art discloses fibrous polysaccharides activated by plasma in order to form radicals on the saccharide chain and carrying functional groups directly bonded to the saccharide chain through a stable carbon-bond.

3). Art. 33(3) PCT (Inventive step) :

D1 discloses a surface treatment of fibrous products from polyethylene or polyester. Free radicals are formed by using low temperature microwave plasma to activate the surface. The monomers are grafted with functional monomers to gain specific water affinity function.

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1.

The problem to be solved by the present invention may therefore be regarded as to provide a method for functionalising polysaccharides.

The solution proposed in claim 1 of the present application can be considered as involving an inventive step (Article 33(3) PCT) for the following reasons.

D1 relates to synthetic polymers, which are quite different from the polysaccharides such as flax, cellulose, viscose or cotton.

It was rather surprising that the Applicant was capable of functionalising polysaccharides by the formation of stable carbon-carbon bonds on the polysaccharide chain.

### Claims

1. Method for functionalizing polysaccharides using a source of free radicals which forms stable radicals on the polysaccharide structure and wherein the formed radical reacts with a functionalized olefin, characterized in that the method comprises two steps: a first step, wherein the free radical on the polysaccharide chain is formed, and a second step, wherein said radical reacts with the olefin in the absence of the radical source.
2. Method according to claim 1 wherein the source of free radicals is a chemical source or a physical source.
3. Method according to claim 2 wherein the physical source is selected from cold plasma and electron beam radiation, and the chemical source is Fenton's reagent.
4. Method according to claims 1-3 wherein the polysaccharide is selected from the group consisting of flax, cellulose, viscose, cotton, starch.
5. Method according to claim 4 wherein the polysaccharide is used together with one or more natural or synthetic fibers.
6. Method according to claim 5 wherein the natural or synthetic fibers are selected from silk, polyamide, polyester, polyacrylate and polyolefin.
7. Method according to claims 1-6 wherein in the first step the radicals are generated by electron beam and the radiation dose is comprised between 10 and 400 kGy.
8. Method according to claim 7 wherein the radiation dose is comprised between 20 and 200 kGy.
9. Method according to claims 1-8 wherein the polysaccharide is in the form of a fiber.
10. Method according to claims 1-9 wherein the stable radicals have a half-life of about 1 day.
11. Polysaccharides obtainable by the method of claims 1-10.
12. Polysaccharides according to claim 11 wherein the ratio mol olefin/eq anhydrous glucose is comprised between  $10^{-3}$  and 2, preferably between  $10^{-2}$  and 1.
13. Process for the preparation of functionalised polysaccharides or polymer fibers which process comprises:
  - a) forming stable radicals on the polysaccharide from a free radical source; and
  - b) reacting in the absence of the free radical source an olefin containing a functional group with the stable radicals on the polysaccharide.